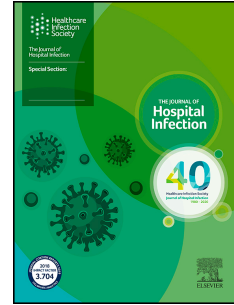# Journal Pre-proof

Implementation of minimum structural requirements for infection prevention through digitalization

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1 **Title Page**

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3 **1 Title of the manuscript**

4 Implementation of minimum structural requirements for infection prevention through

5 digitalization

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39 Hospital employees are the backbone for implementing hospital hygiene knowledge and

40 standards. Their continued education is essential. Conditions associated with optimal

41 dissemination and implementation of hygiene standards and guidelines in hospitals include

42 flexible and contemporary access to knowledge, periodic training of staff and the integration

43 of available principles into healthcare work without critically affecting existing resources.

44 With respect to topic-specific training Silverberg *et al* encouraged establishment of effective,

45 evidence-based approaches to training prescribers in light of the global challenge of

46 antimicrobial resistance [1]; Davis-Beattie and de Wit highlighted 'creative infection control'

47 to counteract low staff knowledge and non-compliance of infection control policies [2]; and

48 O'Neill *et al* reported a statistically significant improvement in the knowledge base in

49 infection prevention and control [3].

50 Considering the aforementioned in conjunction with the WHO's guidelines on transforming

51 and scaling up health professionals' education and training [4], effective and modern learning

52 approaches in infection prevention and hospital hygiene need to consider various aspects with

53 respect to training implementation projects.

54 In Switzerland, the Federal Office of Public Health (FOPH), Division of Communicable

55 Diseases, published the NOSO strategy, which creates the basis for a targeted and coordinated

56 approach. The aim of the national strategy for the surveillance, prevention and control of

57 healthcare-associated infections (NOSO strategy) is to reduce the number of healthcare-

58 associated infections in Switzerland. This framework specifies seven key components for

59 healthcare facilities (i.e. 'minimal standards' [5]).

60 Our main target was to align to the NOSO strategy through a contemporary digitalization

61 implementation project.

62 The objectives of this modernisation were therefore to introduce a fully electronic hygiene

63 folder and an e-learning training for all employees in the hospital care region of Central

64 Switzerland, as well as to assess the success of the implementation.

3

65   The project had two phases (P). P 1 with the introduction of a sharepoint-based electronic

66   hygiene folder. P 2 with the implementation of e-learning on hospital hygiene. The e-learning

67   introduces the hygiene folder, teaches hospital hygiene essentials, and motivates for job-

68   related self-study and document use. It is structured into a series of six topics and expandable

69   by themes at any time. Current topics are 'electronic hygiene folder', 'standard hygiene

70   procedures', 'hand hygiene', 'multi-resistant pathogens', 'types of isolation', 'needle sticks

71   and cuts'. The scope of each module is no longer than three power point-like slides. Interface

72   links allow users for navigating from the e-learning to the resource P 1. Navigation between

73   documents is also possible and realized by keyword-hyperlinks. The scope of innovation

74   included approximately 1,600 staff with 300 occupancy practitioners. Participation was

75   compulsory, and staff received invitations and reminders by e-mail.

76   Months after implementation we evaluated the project. The introduction date of the e-learning

77   created a pushing effect on the electronic hygiene folder (Figure). The average number of hits

78   (navigation of users) increased by a factor of 1.8 from 717 in January to 1,304 in February

79   2022. The average value of unique users increased by a factor of 2.4 in January from 192 to

80   461 in February 2022. There is a stable average use of 860 hits and 230 unique users per

81   month since May 2022. We note that seven months after the introduction of the e-learning,

82   staff have achieved a good completion rate (85.1%, 4.6%, and 10.3% with statuses

83   'completed', 'pending', and 'over-due'). In total the project consumed 290 hours workload of

84   a well-coordinated hospital hygiene team and the support of information and communication

85   technology and electronic learning team members.

86   Although our study does not examine any effects on achieving good practice in hygiene

87   procedures (e.g. hand hygiene), it demonstrates that the electronic hygiene folder and the e-

88   learning have both been implemented successfully. The impact on compliance with good

89   infection prevention practice and on clinical outcomes would need to be addressed in further

90   studies.

91 Based on the numbers of participants, it can be deemed that the project has successfully been

92 implemented. The two key components 'guidelines and directives' and 'task-oriented

93 training' of the NOSO strategy are fully realized. Compared with other projects our project

94 presents a pragmatic approach with the actual implementation into business operations and

95 measurement of its use. We share the opinion of Spanjers *et al* that e-learning cannot be

96 perceived as a substitute of a traditional face-to-face education, but when the e-learning

97 environment is socially well structured, it becomes an efficient support to education in the

98 hospital context [6]. Noesgaard and Rikke Ørngreen's study on the effectiveness of e-learning

99 suggested three perspectives for promoting e-learning effectiveness: the context in which the

100 e-learning solution is used, the artefact (the e-learning solution itself) and the individuals that

101 use the artefact [7]. Scrutinizing those three retrospectively on our project, we conclude that

102 digitalization of hospital hygiene knowledge is possible with moderate effort in an effective

103 way, and that an appropriate access promotes the use of the electronic folder.

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111

112 **Contributions**

113 Concept und Design: TW Leiblein, R Sommerstein.

114 Development of the electronic hygiene folder and the e-learning: TW Leiblein, R

115 Sommerstein, M Gligor, E Seger, K Scheiber.

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116 Writing of the paper draft: TW Leiblein, R Sommerstein.

117 Critical revisions for important intellectual input and final approval: all authors.

118

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121

122 **Potential conflicts of interest**

123 The authors report no conflicts of interest relevant to this article.

124

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150   **Figure Legends**

151   **Figure**

152   Use of the electronic hygiene folder per months since its introduction on 1 October 2021.